

University of California
College of Engineering
Department of Electrical Engineering
and Computer sciences

EE140

Midterm Exam

Mar. 13, 2003

Name: _____

SID#: _____

grad undergrad

- Closed book except for 1 - 8.5" x 11" sheet of your notes.
- There are two problems. Be sure to show all your work to receive full or partial credit.

1	
2	
Total	

b) (10 pts.)

Determine the common mode input range, consistent with keeping all devices active.

c) (10 pts.)

If $V_{i_2} = V_{DD}$, determine the output range, consistent with keeping all devices active.

d) (10 pts.)

For the operating point with $V_{I_1} = V_{I_2} = V_{DD}$, determine the differential mode circuit

$$G_m, \text{ i.e. } G_{m_{diff}} = \frac{i_{out}}{(v_{i_1} - v_{i_2})}$$

e) (10 pts.)

For the operating point with $V_{i_1} = V_{i_2} = V_{DD}$, determine R_{out} .

f) (10 pts.)

Determine the common mode gain, i.e. $A_{v-cm} = \frac{v_0}{v_{in}} \Big|_{v_{i_1} = v_{i_2} = v_{in}}$.

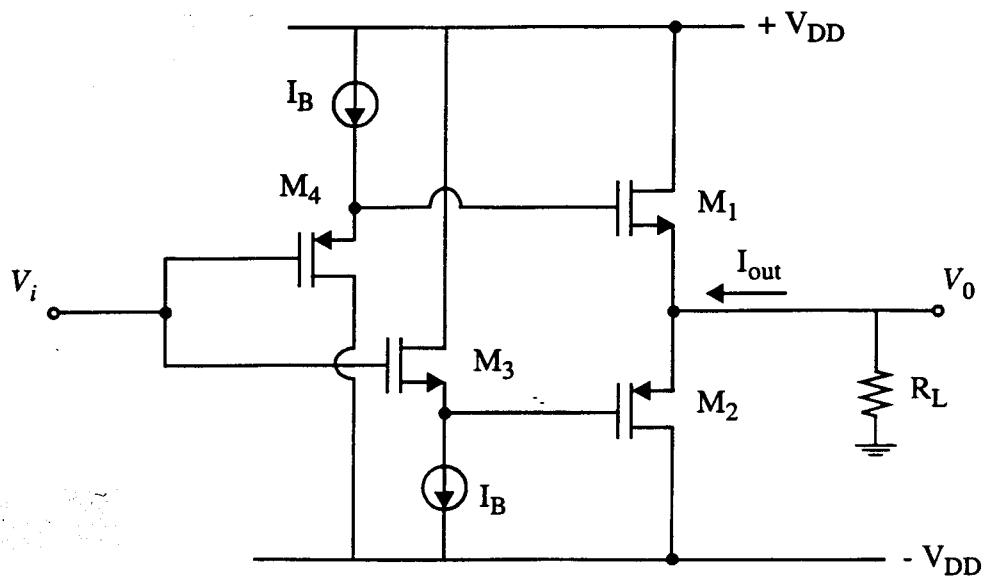


Fig. 2

2) For the circuit of Fig. 2, take the following: $\left(\frac{W}{L}\right)_1 = N\left(\frac{W}{L}\right)_3$; $\left(\frac{W}{L}\right)_2 = N\left(\frac{W}{L}\right)_4$;

$k'_n\left(\frac{W}{L}\right)_3 = k'_p\left(\frac{W}{L}\right)_4$. Neglect body effect and channel length modulation.

Assume $V_{T_n} = V_{T_p}$.

a) (10 pts.)

For $V_i = 0$ and $R_L = \infty$, determine V_0 , I_{D_1} and I_{D_2} .

V_0	
I_{D_1}	
I_{D_2}	

b) (10 pts.)

For the bias condition determined in part (a), determine the circuit G_m .

c) (10 pts.)

For the bias condition determined in part (a), determine R_{out} .

d) (10 pts.)

Take $V_i = 0$ and $R_L = \infty$. Determine the large signal $I_{\text{out}} - V_0$ curve obtained by applying an appropriate test source at the circuit output.